

JUL 11 2007

Docket No.: 0941-0761P

Application No. 10/600,619
Amendment dated July 11, 2007
After Final Office Action of May 11, 2007

REMARKS

Claims 1, 2, 4, and 6-21 remain present in this application.

Claims 1, 2, 4, 6-8, and 11-21 stand rejected under 35 USC 103(a) as being unpatentable over Rajendran, U.S. Patent 5,981,097, in view of International Publication WO/ 96/29752, and further in view of Asukabe, U.S. Publication 2001/0026893. This rejection is respectfully traversed.

Claims 9 and 10 stand rejected under 35 USC 103 as being unpatentable over Rajendran in view of Asukabe, and further in view of Murphy, U.S. Patent 6,059,943. This rejection is respectfully traversed.

Independent claim 1 recites (emphasis added):

1. A layered proton exchange membrane, comprising:
an organic/inorganic composite membrane, comprising in-
organic proton conductor and organic base polymer; and
at least one proton exchange organic membrane consisting
of an organic component;
wherein the organic base polymer and the base material
of the proton exchange organic membrane are poly(vinylidene-
fluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS),
PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-
poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic
acid), PVDF-g-Sulfonated-poly (2-vinylnaphthalene), or
PVDF-g-Sulfonated-poly(9-vinyl- anthracene).

Independent claim 13 recites (emphasis added):

13. A method for preparing a layered proton exchange
membrane, comprising of:
(a) forming an organic/inorganic composite membrane by
doping inorganic proton conductor in organic base polymer; and
(b) combining the organic/inorganic complex membrane
and a proton exchange organic membrane consisting of an organic
component to form a layered proton exchange membrane;

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wherein the organic base polymer and the organic component are poly(vinylidene fluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly (N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl-anthracene).

Independent claim 19 recites (emphasis added):

19. A direct liquid-feed methanol fuel cell, comprising:
a cathode;
an anode; and
a layered proton exchange membrane, formed by lamination of an organic/inorganic composite membrane with at least one proton exchange organic membrane;
wherein the organic/inorganic composite membrane comprises organic base polymer and inorganic proton conductor, and
the proton exchange organic membrane consists of an organic component;

wherein the organic base polymer and the organic component are poly(vinylidene fluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl-anthracene).

In independent claims 1, 13 and 19, the organic base polymer and the organic component are PVDF based polymer such as poly(vinylidene fluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl-anthracene). The Examiner's attention is drawn to page 6, lines 9-14 of the specification. It is also noted that, in claims 1, 13, and 19, the first part of the polymer is PVDF (a fluorinated polymer); and the *second part of the polymer is sulfonated but not fluorinated*, such as sulfonated styrene, sulfonated N-vinylcarbazole, etc.

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Rajendran teaches copolymers of a first fluorinated vinyl monomer together with a second fluorinated vinyl monomer having a sulfonyl group (see column 3, lines 44-46). The first monomers include vinylidene, however, *the second monomers include a variety of fluorinated vinyl ethers with sulfonated functional groups* (see column 3, lines 47-53).

In other words, *all of the second monomers of Rajendran are fluorinated*. The Examiner's attention is drawn to the polymer formula in column 3, lines 61-62 and column 4, lines 4, 8, 13, and 17. It is again noted that not only are the first polymers fluorinated, but the second polymers are fluorinated as well. Obviously, Rajendran teaches away from a polymer having a fluorinated first part and a *non-fluorinated second part*, such as the PVDF-g-SPS of the present invention.

The secondary reference to International Publication WO/ 96/29752 fails to overcome this deficiency.

With regard to Asukabe, as previously in the previous response, this reference teaches only a single polymer electrolyte membrane comprising PVDF-g-SPS (see paragraphs 33 and 34). Since Rajendran fails to teach membranes utilizing copolymers having fluorinated first monomers and non-fluorinated second monomers, it is respectfully submitted that there would be no motivation to one of ordinary skill in the art to combine the PVDF-g-SPS of Asukabe in the membrane of Rajendran, especially considering that *Rajendran teaches away from the material of Asukabe*. It is again respectfully submitted that the Examiner has combined these two references based on a hindsight reconstruction of the claims of the present application, and that the suggestion or motivation to combine these references is found in the present disclosure.

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With regard to Murphy, it is noted that, although the membrane of Murphy utilizes a copolymer of PVDF and polysulfone, there would also be no motivation to one of ordinary skill in the art to combine Murphy and Rajendran, in light of the fact that *Rajendran teaches away the material of Murphy*.

In view of the foregoing remarks, it is respectfully submitted that the prior art utilized by the Examiner fails to teach or suggest the layered proton exchange membrane, method for preparing a layered proton exchange membrane, and direct liquid-feed methanol fuel cell, as set forth in independent claims 1, 13 and 19, as well as their dependent claims. Accordingly, reconsideration and withdrawal of the 35 USC 103 rejections are respectfully requested.

Conclusion

Favorable reconsideration and an early Notice of Allowance are earnestly solicited.

In the event that any outstanding matters remain in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

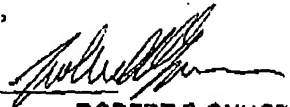
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If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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